AGRICULTURAL
Research

MARCH 1962/U.S. DEPARTMENT OF AGRICULTURE

Minimum Tillage of WINTER WHEAT?

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Research

March 1962/Volume 10, No. 9

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Irrigation

Irrigation, now practiced in varying degrees in every State, has opened many new frontiers for American agriculture.

Irrigation provides a stable, diversified agriculture. It augments the overall agricultural economy, and it helps ensure adequate production to meet present and future demands of our expanding population.

Considerable progress has been made in developing methods of handling irrigation water. However, there are still many problems associated with irrigation that must be solved.

Research has made us better acquainted with soil structure, texture, and depth and layering. These are important properties for estimating a soil's water-holding capacity, the rate of entry of water, and the rate of water movement through soil.

Research has shown that sorghum yields can be doubled by terracing and benching land in semiarid areas of the Great Plains to save runoff which frequently occurs during heavy summer storms. We have learned that an area can be covered with plastics to get nearly 100 percent runoff, which can be stored for later use. Plastics are expensive and often deteriorate rapidly when exposed to normal outdoor conditions. Other quite promising materials have been studied.

Seepage and evaporation are major causes of water loss from storage basins. Polyethylene film, placed on a farm pond, reduces seepage losses to practically zero. More economical ways of reducing seepage losses are being sought.

Reduction of evaporation by 15 to 20 percent has been obtained by putting hexadecanol on a pond surface. In Utah studies, 87 percent of evaporation was prevented by floating a plastic film on small ponds.

Methods of irrigation have been studied; so have the kinds of ditches and structures needed to carry and place irrigation water where it is needed. We're also learning more about complex soil-water-plant relationships so we can do a more effective job of using irrigation water.

Additional progress in making efficient use of water depends only on the imagination of scientific minds and the facilities provided them for research.

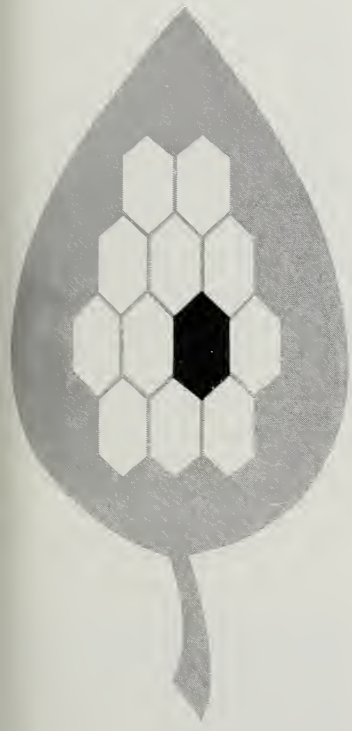
AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington 25, D.C. Printing has been approved by the Bureau of the Budget, August 15, 1958. Yearly subscription rate is $1 in the U.S. and countries of the Postal Union, $1.50 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington 25, D.C.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Growth Through Agricultural Progress

LEARNING HOW VIRUSES DEVELOP

Latest development in battle against viruses: isolation of an immature form of tobacco mosaic from tobacco leaves



■ By isolating an immature form of tobacco mosaic virus (TMV) from leaves of infected tobacco plants, a USDA scientist has opened the way to learning how viruses develop and cause disease in plants.

In research in the Pioneering Laboratory for Plant Virology, Beltsville, Md., ARS plant pathologist T. O. Diener has extracted a developmental form of TMV that is believed to be ribonucleic acid (RNA).

Researchers may now be able to study the steps involved in formation of virus within plant cells.

Up to now, scientists have been able to isolate only mature or complete forms and noninfectious incomplete forms of viruses from plants. They have broken down viruses outside of plants and learned their physical and chemical makeup. TMV, like other plant viruses studied, consists of RNA surrounded by protein.

But these smallest and least complex organisms have remained perhaps the most mysterious of living things, because they are known to show activity—to grow or develop—only within a host.

Scientists have shown that RNA is the basic genetic material in TMV capable of reproducing the organism. (RNA is a sister nucleic acid to DNA—deoxyribonucleic acid. DNA forms the genetic material of plants and animals, and some animal and bacterial viruses.) Inoculation of plants with only the RNA portion of TMV produces infections like those resulting from inoculation with the complete virus. Other workers have demonstrated that viral RNA is present in plants in the early stages of infection by TMV.

Turn Page

VIRUSES
(*Continued*)

The first step in the reproduction of TMV is believed to consist of the release of RNA from its surrounding protein.

But recovery of this free RNA from infected plants has been complicated because, during the extraction process, RNA may be destroyed by an enzyme released from the plant material. Or the RNA may become inseparably attached (by adsorption) to the surface of other materials.

Diener believes a buffer solution he developed for the extraction overcomes these difficulties. It consists of glycine, potassium phosphate, and sodium chloride at an alkaline pH of 9.5. Glycine and potassium phosphate are used to stabilize the pH. The enzyme that destroys RNA is inactive at this pH, and adsorption of RNA to other materials is prevented by the salt in the solution.

TMV doesn't break down in this solution, excluding the possibility that RNA extracted results from disintegration of the complete virus.

Diener obtained more RNA from tobacco leaves harvested 2 to 3 days after inoculation than from leaves harvested 7 or more days after inoculation when virus content had reached its maximum.

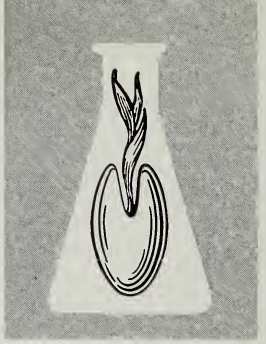
In the actual process, TMV and RNA together are first extracted from infected leaves by homogenizing them in a mixture of buffer and chloroform, followed by low-speed and high-speed centrifugations.

The particles of free RNA and complete TMV differ in density, so Diener uses density gradient centrifugation, developed by ARS biochemist M. K. Brakke (AGR. RES., Feb. 1956, p. 3), to separate them.

In this method, quantities of Diener's buffer, containing different amounts of sugar, are layered into a centrifuge tube, with the solution of greatest density at the bottom. The extract of free RNA and complete virus is floated on top. When this material is centrifuged, the free RNA and the complete TMV move at different velocities toward the bottom of the centrifuge tube. After 12 hours or more each component is in a band separate from the other.☆

Sample drawn from plastic tube will be tested by Diener for infectivity.

Centrifugation at high speed separates RNA from TMV and RNA mixture.



Americans and others in the world have better diets, homes, and clothes because of research that began in the 1800's

■ Modern American living—our better diets, convenient homes, and useful, attractive clothing—reflect USDA research that began as early as 1862.

A century ago, people knew in a general way that what they ate influenced how they felt, but there was little scientific evidence to help them know how much of which foods to eat, and why.

Today, ARS food plans guide people in providing nutritious, balanced diets for every family member—young and old—and to fit nearly any family income. Such nutritional diseases as scurvy, pellagra, beriberi, and rickets were commonplace in 1862, when the USDA came into being. Now, these diseases are practically nonexistent in the U.S.

A major milestone in this transformation was reached in 1896, when USDA issued its now famous Bulletin 28, "Composition of American Food Materials." Chemist W. O. Atwater was the author. The bulletin contained percentages of protein, fat, carbohydrate, ash, and water from 2,572 analyses of foods, basic information for computing diets. (The latest ARS food composition data

Third in a Centennial Series

HOME ECONOMICS

cover more than 2,500 food items and 40,000 values in minerals, vitamins, and total calories—as well as protein, fat, and carbohydrate.)

Special device used in early work

The research of Atwater and his associates has also contributed much to making this a weight-watching, calorie-conscious nation. These early nutrition scientists built a special calorimeter which successfully measured the energy used by people at rest and during various activities. They also developed a simple method of determining energy value of foods from their chemical composition. This early research was the basis for all the calorie calculations used so widely in the U.S. in planning diets and also in designing industrial and household equipment to save the energy of the worker.

Calorimeter (right, center) in 1800's gaged energy used to do wash and other household chores.

In 1888, USDA reported that "the majority of our people and practically all wage-earners spend and must spend at least half the money they earn for food." Today average per capita spending for food is only a fifth of disposable income. Research has made food a bargain.

Similar remarkable advances have resulted from USDA research on housing and clothing.

Since 1931 when USDA research on family housing problems began, ARS scientists in cooperation with 43 State experiment stations have studied housing needs and preferences and then applied these findings to farmhouse plans. The kitchen, center of heaviest labor in the home, has come in for special convenience planning. Research-based, energy-saving kitchens are a major ARS contribution to modern living.

Measurements of space required for all the usual household storage and for each household activity have made possible space standards that now can be used in planning any home for convenience and economy.

The trend to functional design is one of the most significant changes in clothing in the past century. In children's clothes the trend was started by USDA's sunsuit, developed for the preschool child's health and comfort in summer. Designs for snowsuits and self-help clothes for young children followed. Various USDA designs for women's work clothes led to new standards for such garments.☆

Development of energy-saving kitchen was major contribution to making housework easier.

Respiration calorimeter (above) lacked refinements of electronic device (below) that is used by researchers to measure the mineral content of vegetables.

NEW BOLL WEEVIL RESEARCH LABORATORY

Facility is center for an all-out attack against most damaging insect in cotton

■ A major offensive against the most destructive insect pest of cotton gains momentum this month when USDA's Boll Weevil Research Laboratory is dedicated at State College, Miss.

This new facility is the center for a concerted effort by USDA and several State agricultural experiment stations to develop improved methods of boll-weevil control. This insect has cost cotton growers an estimated $10 billion since 1892, when it was first found in this country.

Director of the laboratory is entomologist T. B. Davich, who headed USDA's Cotton Insect Laboratory at College Station, Tex.

Research planned at State College represents a multipronged effort in all phases of weevil control, including a search for improved insecticides, better biological control methods, and resistant varieties of cotton. The work will involve studies in insect toxicology and pathology, insect and plant physiology and genetics, and related research in chemistry, soil science, agricultural engineering, and agricultural economics.

Entomologist S. E. Jones, chief of ARS cotton insects research, Beltsville, Md., cites good reasons for this "all-out attack" on the weevil:

- The cotton industry attributes average annual losses of more than $350 million to the boll weevil. This figure is based on annual USDA estimates made from 1940 to 1954.
- In 1955, the weevil began to show resistance to some of the more potent insecticides in use. Scientists agreed that better controls must be developed so growers could continue making a reasonable profit.
- Cotton damage continues, and the weevil is infesting new areas.
- Preliminary Federal-State research indicates that effective new methods of boll-weevil control can be developed.

Most senior scientists have been hired

The laboratory staff will include 22 senior ARS scientists and their assistants, working in cooperation with the Mississippi Agricultural Experiment Station. Most of the scientists have been employed, and much essential equipment has been purchased. Experiments are now being developed as rapidly as possible.

So far a three-story, air-conditioned main building (278 x 61 feet) and an engineering and storage building (161 x 41 feet) have been constructed. A greenhouse is being built to test insecticides and strains of cotton selected for resistance to the weevil. Buildings to house laboratories for development work on insecticides and chemical sterilants, and research on radiation-induced male sterility are planned.

In a 1959 report, the House and Senate agriculture committees requested the Secretary of Agriculture to review the boll-weevil situation. A series of Federal-State and industry conferences followed. After findings were reported to Congress, $1.1 million was appropriated in 1960 to construct the laboratory.

Last year, Congress appropriated funds for initial operation of the laboratory and provided additional funds for a substantial continuation of planned research this year.☆

Flood-water storage areas are used for holding runoff and, when dry, for grazing livestock

Wanted: GRASSES FOR DETENTION RESERVOIRS

■ Which prairie and pasture grasses will stand flooding such as that caused by runoff from heavy rain? At what season? For how long? At what depth?

USDA is seeking answers to these questions in the new Southern Great Plains Research Watershed near Chickasha, Okla. Research is being done by ARS agricultural engineer E. D. Rhoades and management agronomist M. D. Gamble of USDA's Soil Conservation Service.

Results will have immediate application in flood-water-detention reservoirs being built on the Southern Great Plains. More than 1,000 reservoirs have been built in Oklahoma and Texas and many more are planned.

These reservoirs are constructed as authorized by Public Law 566, enacted in 1954. The reservoirs prevent flooding of streams by restricting or controlling runoff from their upper tributaries. This effort consists of two parts—conservation practices on farmland, and use of dams and other engineering structures in streams. The conservation practices reduce runoff entering the streams, and the dams regulate stream flow. SCS administers this program, in cooperation with local agencies, and ARS conducts the required research.

Each reservoir has conservation pool and flood storage areas

Detention reservoirs consist of two areas—conservation pool and flood storage. The conservation pool stores water and traps sediment collected from upstream drainage areas. The flood storage area is inundated only when there is much runoff. At other times, the storage area is grazed. Grasses with tolerance to intermittent flooding are needed for flood storage areas.

Rhoades and Gamble have constructed six test areas, each 40 x 90 feet. Each area is enclosed by an earth embankment on three sides and has a sloping earth floor. When filled from a nearby lake, these sites become temporary reservoirs, with water ranging in depth from a few inches to 6 feet.

The scientists have established 20 varieties of grass in rows in each test reservoir.

Preliminary data indicates Bermudagrass, some switchgrass selections, buffalograss, vine mesquite, and prairie cordgrass are most promising for areas subject to frequent flooding. These grasses also may be suitable for areas which have a fluctuating water table close to the surface.

The scientists are also testing flooding tolerance of alkali sacaton, eastern gamagrass, western wheatgrass, smooth brome, Kentucky fescue, weeping lovegrass, and four types of bluestem.

Research will continue until the scientists know the flooding tolerance of all important range and pasture grasses of the Southern Plains.☆

Site for testing flooding tolerance of range grasses. It can be filled from nearby lake to simulate flood-water-detention reservoir.

Grasses to be tested are established in rows before the flooding experiments are begun.

Minimum Tillage of WINTER WHEAT

Increased efficiency may result from drilling seed in soil that is worked only by plowing in July

■ Can winter wheat growers increase efficiency by drilling seed in cloddy soil instead of conventionally prepared soil?

They may if additional research supports preliminary findings from USDA-Oregon experiments in the Palouse area of the Pacific Northwest. Winter wheat yields averaging 48.3 bushels per acre were harvested from plots that had no seedbed preparation except plowing dry soil in July. (Seed was drilled in October.)

Scientists consider the results sufficiently promising to justify further research. But they want more information before recommending the practice to growers.

ARS agricultural engineer T. R. Horning and Oregon Agricultural Experiment Station agronomist M. M. Oveson are comparing this method of minimum tillage and conventional tillage (soil plowed and worked until fine and friable) at Pendleton, Oreg. Results of experiments the first 6 years showed:

- Wheat yielded somewhat better on conventionally prepared land, but yield differences were insignificant in 4 of the 6 years. An average of 52.6 bushels per acre was produced in plots worked conventionally. Average yield from the cloddy plots was 48.3 bushels an acre.
- Plowed-cloddy preparation saved 2 to 4 tillage operations per year. At prevailing local rates, average annual cost of minimum tillage was $3 per acre, compared with $5.88 for conventional tillage.
- A cloddy soil surface may help control soil and water erosion during winter.

Erosion in winter is severe in eastern Oregon, Washington, and northern Idaho, especially when the soil surface becomes saturated or is partially thawed. Winter wheat and field peas are grown in alternate years on slopes as steep as 30 percent. Wheat seeded in finely worked soil does not

Pacific Northwest soils are extremely dry in midsummer. Plowing then forms huge clods. But cloddy seedbeds may be suitable for wheat.

make enough fall growth to retard erosion. Half of the 18 to 25 inches of annual precipitation falls between October and February, when wheat fields are most vulnerable to erosion.

Horning and Oveson are using three seedbed preparation methods: (1) Minimum tillage; (2) plowing in July followed by one or two tillage operations each with rotary hoe and springtooth cultivator after fall rains (conventional); (3) V-blade sweep substituted for plow in first operation, followed by rotary hoe and springtooth tillage (conventional).☆

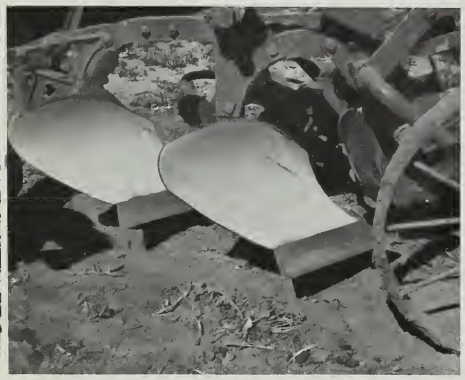
Wheat planted in cloddy seedbed (right of stake) produced nearly as well as wheat in finely worked seedbed (left).

Water from snow flows in seed drill wheel tracks, causing erosion of plow-worked wheat fields.

Plowed-worked soil is very susceptible to erosion in winter. Melting snow and rain cause puddling of soil surface, followed by soil washing.

Plastics might be useful as a coating to prevent soil from sticking to farm implements

INCREASING TILLAGE EFFICIENCY



These H. D. polyethylene-coated plow bottoms showed signs of wear after only 2½ acres of plowing.

Teflon-coated moldboard will turn an estimated 50 acres of highly abrasive, sticky soil before plastic needs replacing.

■ Plastic coverings on tillage equipment may end one of the oldest problems in farming—soil sticking to implements during tilling.

At USDA's National Tillage Machinery Laboratory, Auburn, Ala., ARS agricultural engineers A. W. Cooper and W. F. McCreery covered moldboard plows with sheet plastics that scoured well even in sticky soils. Wearing qualities of the plastics also are being studied.

Of more than a dozen liquid and sheet plastics tested, Teflon (tetrafluoroethylene) and high-density (H. D.) polyethylene—both sheet plastics—shed soil best. They also wore better than other plastics tested.

Teflon and H. D. polyethylene are very smooth, which makes it difficult for soil or other materials to stick to them. Sheets of these extremely tough plastics, which are milky white in color, were cut to size and either bolted or glued to the plows for testing.

Teflon is used to make nonlubricated bearings, electrical insulation, gaskets, and to coat frying pans. H. D. polyethylene is used in making plastic squeeze bottles, wastebaskets, and other household items.

Preliminary tests of each of the liquid and sheet plastics were made in the laboratory. None of the liquid plastics withstood abrasion in these tests and their use was discontinued. Plastics that seemed promising were tested on a larger scale in bins of Davidson clay, a very sticky soil that is difficult to plow. Finally, the sheet plastics were field tested. The Georgia Agricultural Experiment Station, Plains, cooperated.

In the bin tests at Auburn, a steel moldboard plow covered with Teflon did an excellent job of plowing, and the draft required to pull this plow was 23 percent less than for a conventional steel moldboard. Cooper says this is the first time Davidson clay has been satisfactorily plowed with a moldboard plow since the laboratory began using this soil for tests nearly 25 years ago.

In field tests, a rye cover crop was completely turned under and covered with 6 inches or more of soil by a Teflon-coated steel moldboard plow. In an adjacent field, a conventional steel moldboard plow failed to scour and the soil was merely broken loose and pushed over. Soil in these tests was a very sticky clay.

Currently, ARS engineers are working only with coatings for moldboard plows, but they believe plastics might be used to coat any farm implement that comes in contact with the soil. When soil adheres to a plow, poor plowing results, more power is required to pull the tool through the soil, and much time is wasted in cleaning the implement.

Plows covered with either of the two sheet plastics did a good job. But when sheets of equal thickness were compared, the Teflon lasted longer than the H. D. polyethylene. The engineers estimate that a Teflon-coated 14-inch moldboard plow will turn about 50 acres of a highly abrasive, sticky soil before the plastic has to be replaced. The H. D. polyethylene lasted an estimated 20 acres in the same soil.

Research to learn more about plastic coverings of tillage implements is continuing. They are not available commercially. Manufacturers will have to determine, on the basis of potential demand, whether production of such items is economically feasible.☆

NEW MARKET FOR FLAXSEED

■ Commercial linseed-oil-in-water emulsion paints for exterior use, developed in cooperative research by USDA and the National Flaxseed Processors' Association, now offer a new market for flaxseed.

The paints combine good protective values of linseed oil paints with rapid drying and convenience of water-base paints. The paints can be thinned with water. They surface-dry quickly, resist blistering, adhere to chalky surfaces, and wash easily from brushes or rollers.

ARS reported experimental, linseed-oil-in-water paints 14 months ago (AGR. RES., January 1961, p. 12). Since then, Northern utilization division chemists at Peoria, Ill., have developed better emulsifiers, contributed new information about formulation of emulsion paints and how they form films, and discovered a better way to incorporate driers into the paints. As a result, a major company is producing and selling linseed oil-water emulsions for making exterior paints.

The fast-drying and blister-resisting characteristics of these paints are due to film porosity that permits water vapor to escape. A second coat can be applied 30 to 60 minutes after the first application.

USDA-developed reactive emulsifiers make it possible to disperse linseed oil in water and hold the emulsion even after zinc oxide is added. Zinc oxide, a pigment and fungicide, is required in linseed-oil paints, but it tends to destroy oil-water emulsions. The emulsifiers, called reactive because they form films, can be manufactured by commercial methods. And the emulsifier's solubility in water and oil can be controlled by regulating the processing.

Affinity for water or oil is one of the properties manufacturers use to select emulsifiers from more than a thousand surface-active agents commercially available. (Surface-active agents are compounds that aid the dispersion in water of other substances.) USDA chemists defined linseed-oil emulsion requirements in terms of the emulsifiers' affinity for water or oil.

Northern division work shows that chelated (chemically bound) driers in linseed-emulsion paint cannot react with other emulsion constituents to destroy their own drying power and cannot form salts in sufficient amounts to destroy the emulsion. They react as driers, however, when the paint is spread.

The linseed-emulsion research is part of USDA efforts to find new uses for farm crops. This work is expected to bolster the demand for linseed oil, traditional paint vehicle now in competition with synthetic emulsions. Use of linseed oil in paint has declined from 2.2 to 1.2 pounds per gallon in the last 20 years.☆

LEAN LAMB CAN HAVE GOOD EATING QUALITY

■ Is a generous amount of fat in lamb necessary for best eating quality? Many people believe so.

But USDA food specialists conclude that high fat content is not essential to produce good eating quality in cooked lamb and that lean cuts can be tender, juicy, and flavorful.

The ARS researchers obtained their information from recent tests of 224 rib-loin and leg cuts. These types of cuts were chosen because they are the most popular cuts of lamb.

The cuts used varied from very fat to very lean. They were roasted according to a recommended houshold method—in an uncovered pan in an oven at 325° F. until well done. Both raw and cooked meat was analyzed for fat, lean, and bone content.

The fatter cuts, when raw, rated higher for tenderness in mechanical (shear) tests. But when cooked, fat and lean cuts had about the same tenderness ratings. Taste tests of the meat served warm from the oven showed no differences in tenderness, juiciness, or flavor between fat and lean cuts. Neither the fat on the outside of the cut nor the fat interspersed with the lean—marbling—was found to have any consistent affect on eating quality.

The study also showed that the larger cuts generally had a higher proportion of fat. This is a point for consumers to consider when deciding which roast will give the most lean meat per pound.

The 102 lambs that provided meat for this study were all young animals—4 to 14 months old. Cuts from those 11 to 14 months old had a higher percentage of fat than cuts from the younger lambs—4 to 5 months. Rib-loin cuts from animals 11 to 14 months old were less tender than those from the younger animals, but leg cuts did not show this difference in tenderness.

Neither flavor nor juiciness of these cuts when roasted was affected by differences in age of the animals. No mutton flavor was detected.☆

Raspberry yield of virus-free plants (left) was much greater than yield of same number of plants infected by virus (above).

Virus-Free Raspberries on the Way

High-yielding plants of several varieties are being increased for distribution

■ Virus-free raspberry plants that produce four times as much fruit and three times as many sturdy canes as commercial planting stocks of the same variety have been found by USDA and State scientists.

After the number of virus-free plants is increased by USDA, they will be made available to nurserymen through State agricultural experiment stations and other State agencies.

Red raspberry stocks free of mosaic viruses include Canby, Cuthbert, Durham, Indian Summer, Milton, Newburgh, Rideau, September, Taylor, and Willamette. Mosaic-free black stocks: Bristol, Cumberland, Dundee, Morrison, and New Logan.

Reduction in yield caused by mosaic is common in commercial raspberry plantings in the U.S. Controlling mosaic is difficult because the plants are propagated vegetatively from shoot tips or root suckers; cuttings from diseased plants will carry the disease. It is often very difficult to identify infected plants.

When virus-free material is made available to nurserymen, it will mark the first time that known virus-free stocks of these varieties have been generally available in the U.S.

The time required to build up enough virus-free stock for supplying the States will vary with varieties. Stock of some varieties has already been furnished for increase to States where the varieties are adapted.

Virus-free parent stock was collected by State agencies at the request of USDA. State collectors selected what appeared to be the healthiest plants in their areas. These were sent to Beltsville, Md., for determination of freedom from virus and subsequent increase.

Even though the plants had been carefully selected, two-thirds of the 85 commercial stocks tested by ARS plant pathologist R. H. Converse were infected with mosaic virus. The difficulty in identifying diseased plants was further illustrated when it was found that only one-third of the infected plants showed visible symptoms of the virus, such as leaf puckering, blistering, and mottling.

Aphids were used to test plants

Certain aphids spread mosaic viruses. To find which plants were virus-free, USDA scientists allowed aphids that were free of virus to feed on shoot tips of the desired commercial raspberry stocks. These aphids were then placed on black raspberry seedlings known to produce virus symptoms when infected.

Commercial stocks were judged virus-free if no symptoms appeared on the test seedlings. The results of these tests were further checked by grafting leaves from the same commercial stocks to other disease-free indicator seedlings.

Several of the mosaic-free stocks were judged free of virus by the Canadian Department of Agriculture.

When virus-free stocks become commercially available, their continued freedom from virus will depend on the prevalence of aphids in the area and whether growers can control aphids. Infected brambles, wild and cultivated, will also have to be eradicated from the vicinity of the virus-free plantings.☆

THISTLE DIFFERENCES MAY INFLUENCE CONTROLS

■ Canada thistle plants may look different at different locations. These differences in appearance may account for variations in the weed's response to herbicide treatments, says ARS agronomist J. M. Hodgson.

Differences he found in Canada thistles, or creeping thistles, from 10 locations in Idaho, Montana, Washington, and Wyoming provide a basis for research on thistle control.

For example, thistle plants from Fergus, Mont., are wavy-leaved; those from Gallatin, Mont., are flat-leaved. Hodgson found that 2, 4–D treatments at bud stage eliminated 74 percent of the wavy-leaved growth, but only 44 percent of the flat-leaved growth. His experiments at Bozeman, Mont., were in cooperation with the Montana Agricultural Experiment Station and U.S. Bureau of Reclamation.

Most of the plants were more sensitive in the bud stage than in the bloom stage to applications of 1.5 pounds of 2, 4–D per acre.

Visible differences also seem to indicate the weed's ability to survive after mechanical stress. Cultivation every 21 days eliminated 99 percent of the ruffle-leaved plants from Fremont, Idaho, and Prosser, Wash., but only 81 percent of the wavy-leaved plants from Laramie, Wyo.

Canada thistles from different locations show other variations. The leaves may have numerous spines or a few bristles; they may be waxy and smooth or covered with fine hair on top or underneath. Flower color may vary from shades of purple to pale blue and white. There may be 300,000 to 700,000 seeds per pound.

In the Montana studies, spring emergence of annual shoot growth was consistently early in 2 of the 10 groups and late in 2 of the groups. The plants that had the earliest shoot emergence also had the earliest formation of buds and flowers. This characteristic can influence the weed's competitiveness with a crop.

An early emerging type would get an earlier start in competing with a spring wheat crop and cause greater losses than a late-emerging type, Hodgson believes.☆

This Year: Short-Stemmed Georgia Lilies

■ Georgia Easter lily plants in pots can be marketed with short stems this year because of a growth-retarding chemical treatment developed by USDA scientists.

The Georgia lily—one of the most widely used Easter lily varieties—is normally long-stemmed and unwieldy when grown in a pot. Blooms are usually sold as cut flowers. But researchers found that treatment with phosfon, a growth retardant, induces Georgia lily bulbs to form compact plants ideal for potting.

This is the first season that phosfon has been cleared by USDA for use by florists and nurserymen to control the height of lilies. For more than a year, the chemical has been approved to control chrysanthemum growth (Agr. Res., April 1961, p. 10). Phosfon is also used to make azaleas bloom out of season (Agr. Res., November 1961, p. 15).

When added to the soil at potting time or applied as a drench during forcing, phosfon reduces the height of the upper stem without serious effects on time of flowering or flower number and quality. However, lower leaves of plants overtreated with phosfon become yellowed at blooming time and the stems tend to be limber and easily bent.

Specific recommendations for the use of phosfon on lilies may vary according to section of the country, soil mixture, forcing procedure, and plant variety. Growers may find it necessary to modify USDA procedures to use the chemical.

In the ARS investigations, phosfon powder was added to the potting soil at rates of 1 to 1½ ounces of 10-percent phosfon per cubic foot of soil. A phosfon drench applied during forcing, when plants were 5 to 7 inches in height, was as effective as the powder in potting soil. The solution contained 5 ounces of the powder in 4 gallons of water; it was applied at the rate of 1 cup per 6-inch pot.

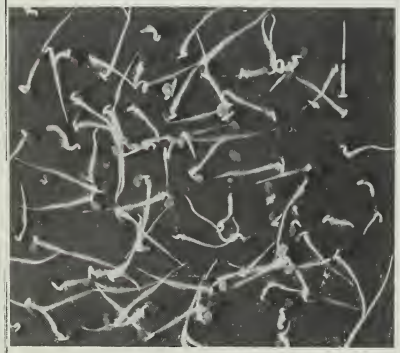
This work was done by plant physiologist N. W. Stuart and agricultural aide M. G. Hickman at Beltsville, Md., and plant pathologist D. L. Gill at Tifton, Ga.☆

Georgia lilies received phosfon in soil (right) and as drench (center). The tall lily wasn't treated.

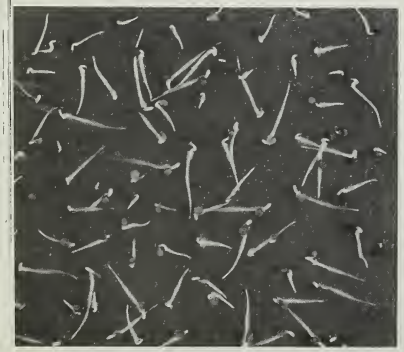
PAC
Effective Against Seed Diseases

Chemicals now used don't seem to be as effective as phenacridane chloride

No fungi or bacteria are growing on seed (bottom) treated with PAC; Bacteria, not fungi, are on seed treated with thiram (top).



Thiram applied to seed *controlled growth of fungi. Bacterial growth wasn't controlled.*



PAC gave good control of fungi and bacteria that often cause disease when seeds germinate.

■ PAC, a chemical developed for medical purposes and used experimentally as a foliar fungicide, appears more effective against some *seed* disease organisms than chemicals now used.

This chemical (phenacridane chloride) is unsuitable for medical uses because it produces an undesirable intense yellow stain. For agriculture, however, the stain is useful because it shows that seeds have been treated.

In laboratory tests by USDA scientists, PAC killed fungal and bacterial disease organisms on seed surfaces, but did not slow seed germination as much as other seed-treating chemicals tested.

PAC and a thiram formulation often used as a seed fungicide both killed fungal spores on the surface of tomato, pepper, and eggplant seeds. In addition, PAC killed bacteria such as those causing serious tomato leafspot disease. Thiram did not kill these bacteria and slowed germination slightly. Percentage of germination was not reduced by either treatment.

PAC is highly soluble in water and spreads uniformly over the surface of seeds. They may be soaked, dipped, or sprayed with the chemical. Once applied, PAC is bound somewhat more tightly to the seed surface than other chemicals used against disease organisms.

In testing persistence of the chemical, the scientists washed treated seeds in running tap water for 24 hours and placed tomato leafspot bacteria on them. Enough PAC remained on the seeds to kill the bacteria.

Neither PAC nor thiram is effective against bacteria and fungi located *within* seeds. Mercurial compounds, formaldehyde, or heat treatments are required to eliminate disease organisms inside seeds.

PAC is not known to be hazardous or allergenic to humans or animals. Further research is required, however, to completely test safety of applying PAC or handling treated seed.

Discovery of PAC's merit as a seed treatment was made at Beltsville, Md., by ARS pathologist B. C. Smale, research technician M. D. Montgillion, and collaborator E. H. Toole. (See AGR. RES., April 1961, p. 5.)☆

DHIA cows break production record

Another record-setting year for cows in the Dairy Herd Improvement Association program: 10,796 pounds of milk and 418 pounds of butterfat per cow. These averages were established during the 12-month period starting in May 1960.

California ranked first among States, averaging 12,019 pounds of milk per cow. Utah ranked second and Arizona third.

Since 1950, milk yield from cows in the DHIA program has increased 20 percent and butterfat production 15 percent. The new milk production record is 4,000 pounds higher than the national average for all cows.

The DHIA program is administered by ARS, in cooperation with State agricultural extension services.

Bees change work in hot weather

Bees may spend more time cooling their hives than producing honey or pollinating crops when temperatures exceed 100° F., a USDA study has shown. (Cooling is done by the bees flapping their wings to evaporate water they take into the hives.)

And as air temperatures climb above 100°, bees use more water for cooling hives than when temperatures are below 100°, ARS agricultural engineer C. D. Owens and apiculturist A. W. Woodrow discovered in research at Tucson, Ariz. They also found that bee colonies die within 24 hours when no water is available and air temperatures exceed 100°.

In one test where the outside temperature was 100° or more and water was withheld several hours, hive temperatures dropped 8 or 9° within 3 hours after water was made available.

These results are based on only 1 year of research. Currently, Owens and Woodrow are making studies to find how close water should be to hives, and how much water is required under various conditions.

Ona potato stocks are available

Limited stocks of seed of Ona, a new high-yielding, disease-resistant potato variety, are available.

In a 5-year test in Florida, the new variety outproduced Pungo and Sebago, two varieties widely grown in that State. In 2 years of tests in Maine, Ona yielded slightly more than Chippewa and Katahdin. Ona has shown some promise in California and Minnesota.

Ona has good chipping qualities at harvest time and after storage. The tubers are medium oblong in shape and have a smooth white skin and shallow eyes. Plants of this variety are resistant to late blight, scab, and Verticillium wilt, and are immune to mild mosaic in the field.

No seed is available from USDA. Inquiries about sources of seed should be directed to ARS horticulturist A. E. Schark, Aroostook Farm, Presque Isle, Maine.

National board to review alfalfas

The National Certified Alfalfa Variety Review Board has been established to evaluate information in applications for certification of new alfalfa varieties, and to make recommendations to certifying agencies.

The reviewers, representatives of public and private agencies, serve only in an advisory capacity.

This board was established after recommendation by the Joint Alfalfa Work Conference—representatives of ARS, the three regional Alfalfa Improvement Conferences, American Seed Trade Association, State seed-certifying agencies, and State agricultural experiment stations.

Agronomist C. H. Hanson, leader of ARS alfalfa investigations, serves as nonvoting chairman of the board.

Aid in preserving poultry stocks

To aid tomorrow's poultry breeding and research . . . that's the aim of a plan, being worked out by ARS, for preserving stocks of poultry breeds, strains, and inbred lines.

A registry of poultry germ plasm, to be published yearly starting in 1962, will list mutant stocks, inbred lines, and purebred strains of chickens, turkeys, and other poultry that breeders have in this country and in Canada. Owners and amounts of available stocks will be shown for each line or strain.

This will indicate plentiful stocks so breeders can avoid duplication of effort. The registry will also show if there are any stocks so few in number they might be in danger of becoming extinct. In that event, cooperative efforts will be made to increase their numbers.

Why worry about such stocks? Characteristics of some poultry breeds not deemed useful now could become valuable in the future. Market demands change, as do ways of getting maximum yield and quality from poultry. And popular breeds can

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become scarce in a short time. In the late 1940's, New Hampshire hens produced more broilers than females of any other breed. White Rock hens are used most today; few New Hampshire chickens are being kept.

Poultry husbandman P. B. Zumbro is setting up the registry. It will be maintained at USDA's Agricultural Research Center, Beltsville, Md.

Zumbro says State and Federal agencies in the U.S. and Canada, and commercial breeders and scientists have expressed interest in cooperating in work on the registry.

Decrease in corn borer population

The average number of European corn borers in important field corn growing areas decreased about a third last fall, compared with borer numbers a year earlier.

USDA and State agencies determined that the average number of borers per 100 plants declined from 142 in 1960 to 97 last fall. The average for the Central States was 70 in 1961, compared with 133 in 1960. The average for the Eastern States was 171 in 1961—up from 164 in 1960—although borer populations decreased in Maryland, Pennsylvania, and Virginia.

Decreases in the Central States were recorded in Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. Cass and Richland Counties, N. Dak., recorded the highest Central State populations—262 borers per 100 plants compared with 474 in 1960.

Counts in Iowa were about the same as in 1960, with a shift in the area of concentration—from northwestern to central and west-central Iowa, where the highest counts were 144 to 199 borers per 100 plants.

In the East, Delaware's average increased to 376 borers per 100 plants in 1961, the largest population found there since 1959. Maryland, Pennsylvania, and Virginia recorded lower averages last fall than in 1960, although southeastern Pennsylvania recorded an increase from 136 to 161 borers per 100 plants. Maryland's highest averages (on the Eastern Shore) were 136 per 100 plants compared with 209 in 1960.

In the South, Arkansas borer populations decreased, and Payne County, Okla., had the lightest infestation found in recent years.

Movable pen for weighing scale

A movable pen that ends the need for a fence around a livestock-weighing scale has been designed by ARS agricultural engineer N. C. Teter.

A fence built around a platform scale to confine animals during weighing often makes it difficult—sometimes impossible—to drive a load of livestock onto the scale.

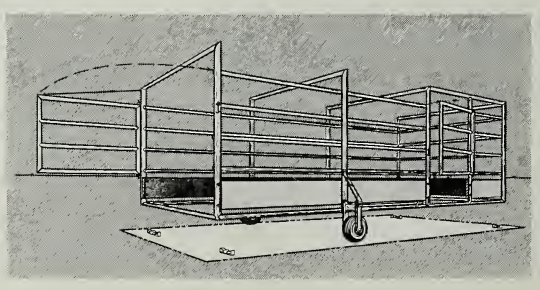
This pen is designed as a do-it-yourself project. Plans for making the pen are flexible and can be adapted to any size platform scale.

The pen is made of 1¼-inch steel pipe cut and welded to size, and weighs about 1,000 pounds.

There are two retractable wheelbarrow-type wheels for rolling the pen onto a platform scale. Travel for long distances or on rough terrain is not recommended.

Here's how the pen works: It is wheeled onto the scale—usually by a tractor. Livestock enter through a rear gate, are weighed, then exit through a side gate. When the scale is needed for weighing a loaded vehicle, the pen is rolled out of the way.

Working drawings of the pen (Plan No. 5932) are available at the agricultural engineering office of most State extension services. Teter is stationed at USDA's Agricultural Research Center, Beltsville, Md.



Livestock enter movable pen through rear gate and exit through side gate after being weighed.

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